

THE NORTH CAROLINA  
AGRICULTURAL EXPERIMENT STATION

W. A. WITHERS, A.M., ACTING DIRECTOR.

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# Farming in North Carolina

Being some Hints as to the more profitable  
use of the Soil and Crops of the State

W. F. MASSEY



RALEIGH, N. C.

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# NORTH CAROLINA COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

RALEIGH, N. C.

## THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

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# FARMING IN NORTH CAROLINA.

BEING SOME HINTS AS TO THE MORE PROFITABLE USE OF THE  
SOIL AND CROPS OF THE STATE.

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W. F. MASSEY, C. E., HORTICULTURIST.

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## INTRODUCTORY.

It may be well said that the farmers of North Carolina "are confronted by a condition and not a theory." The short-sighted policy of the past has placed a large portion of our soils into a very unproductive condition, and the problem that confronts every thoughtful farmer is how to restore and to retain the productiveness of the wasted soils. The idea that a soil originally fertile, and of such a nature as to retain fertility, can be permanently worn out by cropping, we believe to be an error, and we believe that the unproductive condition of much of our clay soils is the result of poor culture, and that they still retain a large portion of their former fertility if properly treated. Of course there are large areas of soils that were naturally thin in the beginning, and these have rapidly been exhausted of their little store. Many deep sandy soils that formerly had a moderate store of vegetable matter have been reduced to absolute barrenness, and these soils being of a leachy nature are the hardest of all to retain in a permanent state of productiveness. But such soils constitute but a small part of our domain. Over a large portion of the state there is a subsoil of the deep red clay peculiar to the piedmont region east of the Blue Ridge mountains, which, when properly treated, is a soil of almost inexhaustible fertility, but which in many places has been so badly treated that it has reached a very unproductive state, and large areas have been turned back to grow up in broomsedge and pines, which under a fairly systematic cultivation might have been retained in a highly productive state for an indefinite period.

Then in the coastal plain there are wide areas of level sandy soil underlaid with a compact clay subsoil, as fertile in its nature as the red clay of the uplands, but which through the slovenly scratching of the past has become very unproductive, but which is the easiest of all the soils of the state to redeem and to maintain in a productive condition if any proper system of farming is adopted in place of the old time planting year after year in a single crop. Then, too, we have in the state large areas of black, peaty soil, that has been reclaimed from swamp, and larger areas of the same that

may still be reclaimed from swamp conditions. Much of this soil is of almost inexhaustible fertility even under the slack system of cultivation to which it has been subjected. But there is with these black, peaty soils a right and wrong way, and the right way is to cultivate and change their character by proper treatment as to retain and increase their natural productiveness to a point far beyond what they have been made to do. It is with the hope that we may be able to throw out some hints that may aid the thinking farmers of the state in the improvement of their land that we write this bulletin, for it is the duty of the Experiment Station to do all in its power to disseminate information on all subjects connected with agriculture and horticulture. And I would say here that we will be always ready in the future, as we have been in the past, to aid the farmers of the state by answering their letters on any subject that interests them.

#### THE ERRORS OF THE PAST.

Over a large portion of the state the soils lie on rolling uplands. When these hills were first cleared from the forests that covered them, the soil filled with vegetable decay, responded readily to the crudest cultivation. The hills did not wash, because the soil was filled with the roots and other vegetable matter that prevented this. But the planting system of the past simply went to work to rob the land of all the fertility available by the shallow preparation in vogue, and kept the land in constant clean cultivation in cotton or tobacco or corn, restoring no vegetable matter to the soil, but fighting grass as an enemy. The humus accumulated in the long ages of forest growth was exhausted and the mellow top soil, underlaid by a compact clay which the little plow had not touched, filled with the water of the heavy rains, ran off the surface and exposed the red clay beneath. The winter frosts mellowed the surface of this clay and the rains washed it, too, away. Thus the hillsides became red galls and later on deep gullies, carrying down their load of soil to the bottoms and to fill the streams, until the rivers that formerly ran clear and sparkling to the sea now carry away in their turbid flood the fertility of the soil. Many of the steeper of these hillsides should never have been cleared from the forest, as the forest cover was the best thing for them, and the best for the lowlands as restraining the rapid rush of water and retaining it to gradually percolate into the land below. Through the waste of the past we have now in many places acre after acre of these galled and gullied red hillsides, the greatest problem that the farmer has to face in their redemption.

But it is not in the steep red hills only that the improvident methods of the past have made waste of the soil. In sections where



the soil is light and sandy and the surface only moderately undulating, this robbing of the humus from the soil has caused a washing and gullying into the mellow yellow subsoil of these lands that is almost as bad in some places as the red gullies of piedmont. These lands did not wash at all when first planted in cotton, for the soil was full of vegetable decay, and they only began to wash after the land had been robbed of this through long years of cotton cropping. In some places the black lands have sunk through the same treatment and have become unproductive for anything but rice. The evident remedy is to practice some method by which the former new ground conditions can be restored to our soils. The question is then how to do this in an economical manner, and how to keep these conditions after we have attained them. All over the South we can see how nature left alone does this. The old field, turned out as exhausted and worthless, soon covers itself with grass and weeds to hide the waste that man has made and to teach him what he should have known, that a soil constantly uncovered, rapidly loses its productiveness. The broomsedge soon waves over the land and adds its annual decay to the soil, unless some thoughtless fellow burns it. Then in the shelter of the broomsedge the pine seed, blown by the wind, finds favorable conditions for its germination and growth. It sends its subsoiling tap root down into the fertile subsoil which the man who scratched over it last did not dream of being there. But down in the store of plant food in that untouched and virgin soil the pine roots penetrate and draw up food for their growth. Year after year the pine sheds its crop of leaves on the ground, adding to the surface the mineral matters it has drawn from far down, and a new soil is gradually formed from the vegetable decay. The broomsedge and the pine have been the salvation of the southern lands, rescuing them from absolute sterility, and year after year teaching to man the lesson of the method for the improvement of these soils. But the lesson has not been heeded, and after the pine has for generations been engaged in the restoration of the soil, some man comes along and clears it off and finds a new and productive piece of land on the old abandoned field, and at once goes to work to rob the soil again of what nature had so patiently accumulated there to give him a fresh start and to teach him how to maintain the fertility she gives. It is the restoration of these new ground conditions that should be the aim of the soil improver. He should try to imitate nature's method, not in the long and tedious way she does, but to enable her more rapidly to accomplish the work she would do if left to herself with the broomsedge and the pine. Man working with nature instead of against her can accomplish wonders in the recuperation of the worn areas. The problem, then, that is before us, is how we can best aid nature in the work of restoring the productiveness of our soils.

## COMMERCIAL FERTILIZERS. THEIR USE AND ABUSE.

From all over the state we are in constant receipt of letters asking for formulas for mixing fertilizers for this, that and the other crop. Men write that they have a piece of land that made a little crop of corn or cotton last year, and they want to know how much fertilizer they must use to make that same piece of worn land produce a big crop of the same thing. The only idea that many seem to have in regard to the cultivation of the soil seems to be that the soil is only something to place fertilizers in, and that for every crop they plant they must buy some fertilizer. As we have time and again remarked, their whole idea of farming seems to be reduced to a mere matter of gambling on the chances of getting a crop enough to pay a profit over the cost of a little fertilizer. We have no antagonism to commercial fertilizers, for when properly used they are efficient aids in the restoration of our soils and in their permanent conservation of fertility. But, *as they have been used in the South*, commercial fertilizers have been the ruin of farms and farmers alike. The idea that each crop planted on the farm must have its due allowance of a concentrated plant food, is largely due to the experiments that have been made in the stations in studying the effects of the different fertilizer mixtures on the different crops, so that the farmers have come to the conclusion that with every crop planted there must be a dose of fertilizer applied that has been found best adapted to its growth, no matter what the condition of that particular soil may be. Our farmers have lost sight of the fact, or perhaps never realized it, that by adopting a system that tends to conserve and retain fertility there is no need for the application of fertilizers to every farm crop grown. True, their production may be increased by such an application and an apparent profit shown, but what we are now after is to show that the farm can be made to improve itself by rational methods, and at the same time give constantly increasing crops while paying for its improvement. While the use of commercial fertilizers in a complete form on every crop grown may increase their product as we have said, the chances are that any such plan will be found an extravagant and wasteful one for the ordinary crops of the grain or cotton farm. Hence, as we do not propose in this bulletin to give any fine spun theories, but to aid the farmer who really wishes to improve his land, in doing it in an economical manner, we do not propose to give a list of formulas adapted to this or that crop, but simply to treat of the use of commercial fertilizers in the proper improvement of the soil for any or all of the crops.



## HOME MIXING OF FERTILIZERS.

Fertilizing matters being a necessity in the recuperation of the soil, their making is a matter of much importance, and the farmer should know just what he is using and no longer buy his fertilizers on "the patent medicine plan." By buying the materials and mixing them at home in the proportions he needs, he can always be sure of having what he wants and of getting it at a much lower rate than the same value could be had from the manufacturers. Some short-sighted fertilizer manufacturers are trying to prevent the farmers from getting the chemicals and doing their own mixing. But they are working against their own interest in this, for the home mixing of fertilizers is going to be the rule in the future, and the sooner the fertilizer men realize it and put all the facilities in the way of the farmer's getting what he wants the more they can make by sales of these things. It has been abundantly proved at more than one station that home mixed fertilizers give just as good results as the same grade of factory mixed goods and cost far less.

## OUR PIEDMONT RED CLAY AND ITS IMPROVEMENT.

All over the southern portion of the rolling uplands of the state east of the Blue Ridge there are thousands of acres that have been washed and almost ruined for any use by the cultivation year after year of cotton on soils of this nature. These rolling uplands were never intended by nature for the clean culture of cotton. They are naturally well adapted to the culture of the grains, grasses and clover, and to the rearing and feeding of stock. It is true that under a rational system of farming cotton might have been profitably grown on these lands at former prices. But the real cotton lands of the state, and the ones to which cotton should be relegated, are the coast plain level lands. The rolling uplands will bring more money in grain, grass and stock than in cotton at present prices, and there is little prospect for its being any higher in the years to come. Hence, while in some sections of the piedmont country it may still be well to keep cotton in the farm rotation, in a large part of this region the crop should never have been grown, and the country would have been far better off to-day if it had not been grown there. All through the region west of Charlotte there are thousands of acres that are devoted to cotton which would have been far better to-day had not a plant of cotton ever been planted there, for the hills then might have been covered with sod and made to feed countless cattle that are now brought from elsewhere to feed the towns. This is an abundantly watered region, and nowhere would the dairy conducted on modern lines be more profitable or do more for the improvement of the land. The rolling hills should be kept in

grass as long as possible to prevent washing, and when the grass fails the soil should be thoroughly prepared and gotten back to grass as soon as possible, and only the more level lands devoted to regular cropping. With the hill lands full of grass roots every time they are plowed, there would be little danger of washing until they get back in grass once more. In all efforts to improve these rolling uplands the idea to keep in view is the restoration of the new ground conditions they formerly possessed by a systematic restoration of the wasted vegetable matter.

In the starting of the improvement of a worn farm in the piedmont red clay, the first thing is to get the land into the proper mechanical condition. Proper breaking and rapid cultivation are worth more in these lands than all the commercial fertilizers ever mixed, for bear in mind that that deep red clay is all fertile soil down to the rock from which it was formed. It is full of plant food and only waits to be exposed to the oxidizing influences of the air to be made productive. This is no theory, but a fact we have proved experimentally. Years ago we had a piece of land of a number of acres in the foothills of the Blue Ridge that was formerly a sharp hill top, but had been graded off full fifteen feet perpendicularly to make a broad plateau for lawns and buildings. The wide stretch of bare red clay was then deeply broken with plow and subsoiler and made a fine bed 15 inches deep. After the frosting of one winter it was sown to blue grass, and no better grass could be found than grew right there. In the preparation of the lawns at our college here in Raleigh, we were in a hurry to see some grass around the building, and rather hastily prepared the soil that had been scratch plowed for generations, fertilized it and sowed seed. On part of the lawn there had been a well that was used during the building of the college, and which we had filled up. But all round the old well lay the red clay that had come from it. On this red clay was the only place we got any stand of grass at all. We then went to work and broke into the red clay all over the space and sowed the land one season in cow peas to restore some vegetable matter, and then prepared the soil and seeded to grass and got a lawn that has been the admiration of every one for years.

These red clay hills have for generations been scratched, many places never having been plowed by anything heavier than a single mule. The hills have washed largely because there was no place for the water to go but to run off the surface and carry with it everything loose. The first thing then to be done in its improvement is to break it. There are soils in which we would never advise deep turning, but the red clays of upper piedmont are not of this character, for they can not be plowed too deep if the plowing is done at the proper time and in the proper condition of the soil. Of course the deep turning must be a gradual thing, for while the subsoil has



a great deal of latent fertility it needs the influence of the air and frost for a while to make it mellow and easily cultivated and the addition of vegetable matter which is deficient in it. But while the turning need not at first be very deep, the breaking should be always deep through the use of the subsoil plow that runs in the furrow made by the turning plow and loosens up without turning the subsoil lower down. In this way we can get the soil loosened to a depth of 15 inches. The red hills have been washing as we have said because there was nowhere else for the water to go. But when we have loosened a bed of soil 15 inches deep, it will take a cloudburst to start it to running, for the mass of loose soil will retain a large rainfall without any wash at all. This deep preparation should always be done in the fall in preparation for some winter crop like small grain. The land is then generally in the best condition for the subsoiling, and it is seldom in fit condition to do this work in the spring. But while deep preparation is always best done in the fall we must guard against the too common practice of leaving plowed land bare all winter. Our lands have deteriorated more through being left without a cover of plant growth in winter than they have from the summer cropping. In the far North, where the soil freezes up all winter, it may be a good practice to plow the land in the fall in preparation for the spring crops, so as to get ahead with the work that crowds them in their short spring. But here where we have more rain than frost the land leaches its fertility very rapidly in winter when exposed. The nitrogen escapes rapidly from such a soil in winter when uncovered, but when there is a soil cover of growing crops of some sort there is hardly any appreciable loss. The keynote to all improvement in our uplands is to never allow them to be exposed without a plant cover at any time except during the culture of the hoed crops in summer. A soil cover of vegetation is one of the essential matters to the improvement of the soil.

Assuming that our upland farm is to be devoted to the culture of grain and the feeding of stock we will now say something in regard to the proper culture of such a farm. We will assume that in its present condition, though it may really have a store of latent plant food in it, it is in that proverbially poor condition "too poor to sprout peas." Very little if any of such land is in that condition, but it expresses what we wish to begin with, a soil that has been so badly used as to be in a condition of utter unproductiveness. In the beginning with such a soil it will be necessary to start its improvement with the use of some of the fertilizer mixtures. We will assume that the deep preparation mentioned has been made, and that by repeated harrowings we have gotten the surface soil into that fine condition and well packed state that the wheat crop requires. For the wheat we will use 300 lbs. per acre of the following mixture: Acid phosphate, 1200 lbs.; cotton seed meal, 600 lbs.;

and muriate of potash, 200 lbs. This will make a ton of complete fertilizer, which at this stage of the improvement will be needed to make a crop, but we will find later on that both the cotton seed meal and the potash can be dispensed with in soil of this character by proper management.

We now seed the field to wheat, using five pecks of seed per acre, and putting it in with a drill, always following the contour lines of the hill with the drill to prevent washing. The crop should be a fair one with this treatment, and as soon as the wheat is off we give the land a dressing of acid phosphate alone and at once sow it in cow peas. In August or early September these will give us a fine crop of hay. Do not be deluded with the idea of what is called "green manuring," but always make every food crop into cured feed for cattle. It was shown at the Alabama station that an acre of cow peas gave a profit of \$10.50 in pasturing them off with hogs, and a large part of the plant was left in the soil with the droppings of the animals. But with the fertilization proposed, the crop of hay should be worth fully \$20 per acre for feeding purposes. No prudent farmer can afford to bury so much food in the soil as green manure, especially since by the proper feeding of it and the careful saving of the manure he can return to the land a large part of the manurial value of the crop in a better shape for plant food, while he has made another profit in the feeding of the stock.

After the peas are cured for hay, chop the stubble up with a disc and sow crimson clover on it at rate of 15 lbs. per acre to make a winter soil clover. If the clover fails, then sow rye for this purpose. During the fall and winter get out all the home-made manure and spread it broadcast on this field as far as it will go, and in spring turn under all the rye or clover with the manure for the corn crop. The corn tend is the place for the accumulation of barnyard manure. It is the place in the rotation where it will do the most good in the permanent building up of the land. We have experimented with commercial fertilizers on the corn crop, and experiments of the same kind have been made at other stations, and we have never seen an instance in which the increased crop paid for the expenditure. Of course there is an increase usually in the crop from such application, but when compared with an unfertilized plot it will be found that the increase does not pay the cost of the application at the price the corn usually commands. Having then prepared the land for corn, let us at once resolve to abandon at once and forever the practice of deep cultivation of the corn crop and the murderous hilling with plows. The plowing for the corn should be deep and thorough, but all subsequent culture should be shallow. For the first cultivation of the crop the best tool is a slant-tooth smoothing harrow run over the whole ground just as the corn comes up. All subsequent cultivation should be with a cultivator run shallow as



possible, and run often enough to keep the surface inch or so always mellow till the corn is too large to get through. Never under any circumstances tear the roots of the corn by deep working, and never under any circumstances take a turning plow into a cornfield after it is prepared for planting. The hilling of the corn is not needed to support it against wind, for the cutting of the roots in hilling makes it easier to blow it down, and the brace roots get a better hold on a level surface than on a sloping bank. Deep preparation and shallow and frequent cultivation is the rule for big corn crops. When you have fed cattle enough from the increasing amount of forage you will have from the peas and corn fodder, and raise manure enough to give the cornfield a light dressing all over, it will easily carry the corn crop and the following crop of winter oats. As soon as the corn is well glazed and while the fodder is still in good condition, cut it off at the ground and cure it in shocks, and thus clear the field so that the oats can be sown in September. This oat crop we will again follow with cow peas the next summer, cure them for hay and get the land in order for wheat again, thus completing a three-year rotation. By this time, if the peas of the second crop have another dose of acid phosphate, the wheat can be made without further addition of fertilizer, and the land should be able to grow clover. When it comes to the point where we can get a good stand of clover after the wheat, we would abandon the oat crop and make the rotation corn, wheat and clover, using the cow peas only in the corn. Or if it is found desirable to continue the oat crop, the rotation can be profitably lengthened so as to include a year of clover after the wheat. In this case the corn will have the benefit of a sod of clover in addition to the manure, the oats will follow the corn, peas after the oats, and wheat after the peas, seeded to clover. This rotation will probably be the very best that could be contrived for such a farm. It will give an increasing amount of pea-vine hay and clover hay and also of corn fodder.

If it be found that on such a farm the stock interest becomes of the leading importance, as it may well become, with the large amount of forage grown, the larger part of the corn crop should be used for making ensilage or the cured fodder and stalks should be shredded to make feed. Finally, after the second or third round of such a rotation it will be found that the only place that there is any need for commercial fertilizer will be on the pea crop in the shape of acid phosphate. Then if the clover in its second spring after sowing has a dressing of lime at a rate of 30 bushels of slacked lime per acre once in six years, it will be found that the abundant potash in that soil will be made available and there will be no need for any artificial application. Such a system, with the deep fall plowing and subsoiling kept up, will rapidly deepen the productive soil, and the farm will increase in productiveness while decreasing in the expense of fertilizers.

## ON A COTTON FARM.

On a farm in the same region where the cotton crop is to be retained as the money crop, we would make the rotation a three-year one and would use the cow pea entirely in place of clover. In this case the cotton would follow on the pea stubble of the previous year. The commercial fertilizer used at first should be a complete one like that recommended for wheat in the start, and the cotton seed of the previous year should be buried in the middles to rot and be reached by the roots just when they need them most, at fruiting time. After the last working, and while the soil is still fresh, the cotton field should be sown in crimson clover for a winter soil cover. On this clover during the winter get out all the farm manure for the corn crop and spread it broadcast. Plow clover and manure in the spring and prepare and work the land as advised for the corn crop before. Cut this corn and cure in shock and put the land in oats in September without breaking again, but merely fining with a disc harrow. Follow the oats with cow peas and make them into hay to feed to stock. In this rotation the peas should have a liberal dose of acid phosphate and potash at first, and afterwards only the phosphate. Lime should be used once in six years on the corn land just before planting and left on the surface to be worked in in cultivation. Lime will liberate the potash in the clay and will also promote the nitrification of the organic matter buried in the soil. In a little while by this rotation and a liberal application of acid phosphate to the peas, it will be found that the cotton crop can be grown without any further addition of fertilizer, the peas giving plenty of nitrogen, and the acid phosphate leaving enough phosphoric acid in the land. The whole idea in such a rotation being to build up the soil for the cotton crop, and in doing it to increase the production of every crop in the rotation, and to do away with the necessity for the purchase of special fertilizers, by making the potash in the soil available and getting the nitrogen by the use of the peas. The growing of the peas will give an increasing amount of cattle food or they can be turned to account in the feeding of hogs on the ground and the making of bacon for profit. In the cotton country proper, the same rotation will be found the best, and there the field feeding of the peas to the hogs will probably be found the best use that can be made of a larger part of them, though some of course should be cured for the feeding of the family dairy cows.

In all the cotton country of the coast plain, the best adjunct to the cotton crop will be found in the hog and its products. The hog will profitably make use of the ripe peas and leave the land in better condition for the succeeding cotton crop than in any other way, and the home curing of the hams and bacon can be made an increasing source of profit. By sowing peas that ripen in succession it



might be profitable to lengthen the rotation another year for this purpose and grow another pea crop, dividing the field temporarily into two parts, one for an early and another for a late pea, so as to keep up the feeding for a longer time. Of course the finishing will be with corn. Later on we will have something to say in regard to the proper curing and marketing of bacon.

#### THE SOUTHERN FIELD OR COW PEA.

For years past we have been urging upon the attention of the southern farmers the great value to them of the cow pea, when properly grown and cured as a forage plant, and we are glad to know that through our efforts the cultivation of this valuable legume has widely extended in the South, and the fact has become manifest that when gradually acclimated northward, the cow pea can be grown successfully far north of the line where its success was formerly thought impossible. The cow pea has not inaptly been called the Clover of the South, and the fact is that it not only takes easily the place of the clover in the South, but in value as a food crop and a soil improver it far surpasses clover not only in the South, but will do for the Southern farmer more than clover will do in the North, but will do it in less than half the time and with much more certainty. Clover often fails even in the North, and is a failure commonly in the South, except in the upland clays of the piedmont section. The cow pea never fails when sown at the proper time, and its rapidity of growth and immense production of valuable forage, fully equal to the best clover for hay, put it far ahead of the clover for the use of the Southern farmer. Then, too, in the first start towards the restoration of a worn piece of land the pea can be depended upon to grow and make a crop on land where clover could not be induced to make any growth whatever.

But there are many erroneous notions in regard to the pea and its value as a soil renewer. Some years ago, one of the correspondents of a farm paper that circulates all over the South, wrote to the editor that he was satisfied that all this talk about the cow pea improving land was pure humbuggery, for he had raised peas on a piece of land for twelve years in succession and the land finally got so poor that it would not grow peas. This shows what peculiar notions some of our Southern people have in regard to the soil and plant-life. The growing of any plant under the sun for twelve years in succession on the same piece of land, and removing the crop will of course exhaust the productiveness of that land, especially for that crop. The pea being such a greedy consumer of phosphoric acid, lime and potash, would doubtless exhaust the land under such circumstances as fast as any plant that could be grown, always taking the same things in the same proportions until the supply of these

things available in the surface soil runs out, and then, of course, the crop fails. The pea will enable us to get nitrogen from the air as no other class of plants except the other members of the pea family will. Nitrogen, when purchased in a commercial fertilizer is always the most expensive part of a complete fertilizer, costing about as much as the other ingredients of the fertilizer together.

A crop of peas of average production will leave in the soil about as much nitrogen in the shape of organic matter and nitrates as we would get in a ton of ordinary fertilizer. Hence a plant that will do this for us is doing all that we can expect any plant to do. But in order that the pea may do this for us, it must have the mineral matters in the soil in sufficient amount and in a readily available condition. It must have an amount of available phosphoric acid, potash and lime sufficient to enable the plant to make its best growth and to develop its capacity for the fixation of nitrogen in the most complete manner.

#### HOW THE PEA GIVES US NITROGEN.

It has long been known that plants belonging to what Botanists call the family of Leguminosæ had in some way the power to acquire and use nitrogen that did not exist in a combined state in the soil. Some asserted that the plants absorbed the nitrogen from the air by means of their leaves. But later investigations have shown that the work of nitrogen catching is not done by the peas or clover or other legume (a legume is a plant of the fruit of which is a legume or pod, hence the name for all the family is Leguminosæ or pod bearers). The real work of getting the nitrogen of which the air is largely composed in the form of a free gas, is done by certain microscopic plants that attach themselves to the roots of this class of plants as parasites. The parasitism, however, in this case is not a harmful one, since the little organisms that feed on the nitrogen gas that penetrates the soil give more to the roots than they take, and the process is a sort of symbiosis, or living together for mutual advantage, rather than a parasitism that is harmful. These little plants, consisting of single cells of living matter, have the wonderful power that no green plant has of feeding on the nitrogen gas, and through this feeding or oxidation of the nitrogen forming nitric acid. Now when an acid is formed in the soil it at once finds some base, such as lime, potash or magnesia, and is transformed into what is called a salt of these substances and the result in this case is the formation of nitrates of potash, lime or magnesia, which green plants like the clover can at once absorb and use in their growth, for it has been proved that all forms of nitrogen in the soil must be changed into nitrates before the green leaved plants can use it. In this process of the formation of nitrates by



the little plants that exist on the roots of the pea, the pea is enabled to take up and store away in its growth a large part of the nitrates formed, and the soil also gets fixed in it in the same form more than the pea takes up and the nitrogen content of the soil itself is increased.

Now when the pea crop is harvested as hay, a large part of this nitrogen is taken in this hay. But in feeding the hay by far the larger part is recovered in the droppings of the stock, and if this is carefully saved and applied, we lose but a small part of the manurial value of the pea, while at the same time we can get the feeding value to make a profit out of in the stock. Another part remains in the roots in the form of organic matter, and this part must go through the process of what is called nitrification in the soil before it becomes available for the growth of other plants that follow the pea. This keeps it in the soil until the following summer, when it rapidly becomes available for plants by changing into the available form of a nitrate.

This process of nitrification in a soil abounding in vegetable matter is brought about by other forms of microscopic plants that flourish in such a soil. Thus a soil abounding in organic matter in a state of decay can readily be called a living soil, while one in which the humus or organic decay has been used out of is really a dead soil. As soon as the dead pea roots are left in the soil, the bacterium of decay sets to work to break down the organic matter and to release the ammonia. Then another form of bacterium takes up the work and changes the ammonia into a nitrite, still another form then changes the nitrite into a nitrate which green plants can use. It has been found that the presence of the carbonate of lime in the soil rapidly hastens this nitrification, and it has further been found that these little organisms have another power that green plants do not possess, of taking from such a combination the carbon they need for their growth. Green leaved plants get their carbon through the decomposition of the carbonic acid in the air, by means of the green matter in the leaves, but these little microscopic plants in the soil get it directly from the carbonate. This explains the way in which an excess of lime in a soil abounding in vegetable decay hastens the process of nitrification or change of organic matter into the available form of a nitrate for the use of the green plants.

We must understand, then, that while the pea will get us plenty of nitrogen in the most available form, it cannot get from the air the mineral matters that are required in its growth. Fortunately, these mineral matters are more easily retained in the soil than the nitrogen is, for while nitrogen in the form of a nitrate very easily escapes from the soil in the drainage waters, the absorptive power of a clay soil enables it to take hold of and retain for the future use of plants the phosphoric acid lime, potash and other matters that

plants need. These are more slowly exhausted. But they are exhausted from the upper soil by the improvident scratch culture of generations, and the soil becomes unproductive. It is right here that the better preparation of the soil by deep plowing and cultivation come in to remedy the mistakes of the past. Into the deeply prepared land the pea is enabled to push its roots and to draw up into the surface soil the mineral matters that are abundant in some of the untouched subsoils, and in this way it can restore to the surface soil much that has escaped beyond the reach of the shallow plowing in the past.

But in many of our soils there has been a real exhaustion of a large part of these minerals, and as we can never get them from the air we are compelled to get them in the form of acid phosphate and potash. The deficiency of these being made good by the application, the result is a largely increased growth of the pea, a larger crop of forage and a larger root development, and hence a larger nitrogen collection. It should then be plain to any one that the mineral fertilizers applied to the pea crop are right where they can exert the greatest influence in the permanent improvement of the soil. The larger the forage crop, the more feed we have for the domestic animals. The more animals we feed well, the more manure we can make and of a better quality. The more manure we make the greater our corn and other crops become from its use, so that it is a progressive ratio all around, for the feeding crops on the farm are the ones that tend more than any other to the increase of the humus in the soil and the increase in the activity of the nitrifying organisms that feed on this organic matter.

Lately there has been an effort on the part of some who imagine that they are in this way helping the sale of commercial fertilizers to decry the value of humus or decayed organic matter in the soil, and the editor of a certain paper devoted to the fertilizer trade has advocated the use of fertilizers only and tells his readers to "give humus a rest," as the fertilizers are all sufficient for the making of crops.

The value of humus does not consist alone in the nitrifying of the organic matter, but it has an importance in the mechanical condition of the soil that is fully equal to its plant food value. It has been found that a soil abounding in this vegetable decay has a far greater capacity for the absorption and retention of moisture than any other character of soil, and as moisture is essential to the perfect solution of food in the soil for plant growth, such a soil gives greater results from the use of the commercial fertilizers than a soil in which there is a little humus. Therefore the maintenance and increase of the humus is as important to the vender of commercial fertilizers as to any one else, and he should encourage rather than discourage the accumulation of organic matter in the soil, so that



his goods can give their best effects. Then, too, it is found that a soil abounding in vegetable matter does not bake and crust as soils do which are deficient in this respect, and such a soil does not wash so readily as others. This any one knows who has cultivated land newly cleared from a forest, where the vegetable matter is in abundance. Such soils even when on steep hillsides do not begin to wash till the vegetable matter has been robbed from them by long and careless culture. We see then the important place that the pea can take in the recovery of the new ground conditions in our own lands and any method of culture that favors its more abundant growth favors the rapid restorations of the conditions that tend to fertility and productiveness. A clay soil may have in it all the elements of fertility, but when it has been run together by long culture without the restoration and maintenance of the humus in the land it rapidly gets in an unproductive condition merely by its mechanical constitution. It fails to get penetrated by the air. Its particles are not separated by the humus, and it is hard to reduce the clods and bring out the plant food into an available state. The breaking up of this impervious condition is one of the chief benefits that the growth of the pea has upon the soil of our red clay uplands.

#### • STOCK FEEDING THE GREAT NEED OF THE SOUTH.

But it is not in its direct action on the soil that the great value of the cow pea comes in to a great extent. We have said something in regard to the great feeding value of the pea crop. Some will say at once: If the growth of the pea is such a benefit to the soil, why not get it at once by plowing under the whole crop. Much has been written in the North especially in regard to what they call green manuring, and many there advocate the growing of crops of clover or peas for the sole purpose of plowing them under for manure. This is a very short-sighted policy anywhere and particularly in the South. The plowing under of a mass of green vegetation in a warm climate, and especially on a sandy soil, is apt to result in the evolution of organic acids to such an extent as at times to render the land so treated for a time wholly unproductive. Green manuring is wrong for another reason. If we turn under at midsummer the green growth, we cut short the nitrogen gathering the plants would do for us, for the greater part of this is done in the latter part of the plant's growth, and by turning it under green we lose a large part of the work that it would have done later on, and at the same time run the risk of injuring rather than benefitting the soil. This is so well known to many who have tried it that it is not necessary to speak further of this point. But the most important point is that we thus bury a crop worth usually at least \$20 per acre as food for stock. Now it must be a remarkably profitable crop that suc-

ceeds such an expenditure of food to make this pay. On the contrary all experiments here and elsewhere have shown that the best way is to cure the peas as hay and to feed them to stock and save all the manure carefully to be returned to the soil. And it has also been proved that fully 75 per cent of the manurial value can be thus saved and that the feeding value can be fully realized in addition and a profit made from the animals fed. The slavish dependence of the Southern farmer on the fertilizer manufacturer has been largely brought about by the failure to make the feeding of stock an important part of our work. Stock feeding and the saving of manure lie at the very foundation of all successful agriculture, and the man who supposes that in the long run he can do with commercial fertilizers alone will find that he does it at the expense of the permanent fertility of the soil. The pea, aided by the application of mineral fertilizers, will give us a good deal of the organic matter that we need, but the organic matter and plant-food in the form of barnyard and stable manure have never yet been fully initiated in chemical matters alone. Where there is no profit in the feeding of stock it is true that we can bury the peas in the soil or feed them off on the ground to hogs and make the soil increasingly fertile, but there are few localities in the South where the feeding of beef or dairy animals cannot be made a profitable part of the farm work. The trouble with many is that they have been brought up to the planting idea and do not care to undertake anything but a cropping, and dislike the constant care and attention that stock feeding demands. Until we get away entirely from the old cropping idea we will never become the systematic farmers that the country needs.

#### CURING THE PEA FOR HAY AND STOCK FEEDING.

There has long been a notion that the cow pea is a very hard crop to save in the form of hay. The many contrivances seen all over the country for the drying of the pea vines attest the general prevalence of the idea. We have tried for some time past to tell how to cure the peas in a perfect and simple manner. But many have failed in the effort, while many others have succeeded in the making of the finest of hay. At the meeting of the North Carolina Horticultural Society at Southern Pines last summer, there was exhibited by one of the members a sample of pea vine hay that was perfectly green in color though completely dry, and had all the leaves retained, and these are the most valuable part, and the part commonly lost in the old methods of curing. Mr. J. Van Lindley, who made this exhibit, has the largest peach orchards in the state near Southern Pines. He has to keep a large force of mules for the cultivation of his orchards, and had been buying Northern hay for them, assuming



that no feed could be grown in that sandy soil. Last year he tried the cow pea and cured them as I have often recommended by putting them when half dry into a barn and letting them cure in the mass. He also cured in the same manner a large crop of peas at his home place in Guilford county. I happened there just as the first wagon load of the half-dry peas was brought to the barn, and found them doubtful in regard to storing them so green. I told them to go ahead and put them in, which was done, and a great supply of the finest hay was the result. Mr. Lindley says that he is now independent of the Northern hay for he can make a ton to the acre on the barren sands at Southern Pines. The whole method is simply to cut the peas and when they are dried enough so that a bunch taken in the hands and twisted hard shows no sap running to the twist, they will do to go in. When once in the barn, they should not be disturbed while heating, but allowed to heat and cure with as little contact with the air as possible. I was in the habit of raking into winrows and cocks, but Mr. Lindley says that he finds that when they begin to heat in cocks before storing, they are more apt to mould, and he prefers to let them lie on the ground and get to the half cured condition. The important thing is to store them while still limp, so that the leaves are saved, for these are the best part of the hay, and are commonly lost in the usual mode of drying completely outside. Care must be taken, however, that there is no dew or other external moisture on them when stored. The fact that nine-tenths of the farmers who have tried this method the past year have succeeded in making the finest of hay should encourage those who failed to try to find the reason for their failure till they too succeed, for if one man can make the best of hay by the barn cure, another should be able to do the same. The sample that Mr. Lindley exhibited was sent to the editor of the *Southern Planter* at Richmond, Va. The editor, Mr. Jackson, is an experienced English farmer, and he said in his next issue that the sample came nearer to the finest English cured hay of anything he had seen in this country. Having this valuable forage at hand, and the corn fodder to balance the ration one should be able to feed stock in the best manner. The method of compounding rations has been well treated in other bulletins from this station and to these we will refer the reader.

#### THE STOCK FEEDING CAPACITY OF THE BLACK PEA SOILS OF EASTERN NORTH CAROLINA.

There is no section of the state where the productiveness of the soil in materials for profitable stock feeding is greater than in the black soils near the coast. In all the region along the railroad leading from Norfolk to Edenton, there are wide areas in which

the only crop seems to be corn grown for the grain. The country along this railroad passes through miles upon miles where in the fall of the year the whole country in sight is covered with corn stalks wasting in the wind, that might under a different management be made to feed innumerable cattle. Here right where a great export business in cattle could be established from the port of Norfolk, the principal interest seems to be in the raising of corn for sale. No country ever became permanently wealthy from the export of raw materials alone. Far greater profits can be made by the conversion of the raw materials into some other form that gives greater profit. The corn of the swamp country would bring far more money in the shape of beef and pork than it does in the shape of grain sold on the market. The owners may imagine that their lands do not need the manure, but experiment will show that it will not be wasted thereon. While the rotation of crops adapted to the upper country would not be the thing for the black lands, there is nevertheless as much importance in proper farming on these lands as there is with any. The ceaseless cultivation of corn alone will certainly not improve their character nor productiveness. It would seem to an observer that here of all regions of the state is the place for the silo and for rational stock feeding. The corn stalks that annually go to waste in the country along the line of railroad east of the Dismal swamp would feed all the beef cattle that Norfolk can consume and leave some for export. With all that great corn product turned into ensilage and fed to stock there could be made a beef business for export purposes that would be far more profitable than that on the prairies, since the location is right at the export point, and this will give the feeders a great advantage even over the West. If the winter feeding of cattle is ever inaugurated there on a large scale, there will be plenty of thin Western cattle to be had, and the exporters will always be anxious to get right at their doors the cattle they need.

With the great corn crop of that region turned into ensilage, and the land at the same time sown to cow peas to be eaten off by hogs, there would be a double product that could not fail to bring in more and more of the ready cash. Packing houses for the hog product would spring up and the sale of manufactured products bring greater wealth and population to the section. Then, if on alternate years the field is sown in cow peas of early and late varieties, and a large part saved for hay, the cattle feeding on the corn silage could have the pea vine hay or pea silage to balance the ration and make a complete food, while the pigs would be growing fat all summer on the abundant peas. With this sort of an alternation of peas and corn with an occasional dressing of lime and some phosphate and potash the soils of that region that have been reclaimed from swamp conditions would remain perennially fertile



and would in fact greatly increase in productiveness from the manure accumulations. With no crops but the corn and cow peas these lands could never be worn out if the products are fed on the place as they should be. The use of the manure would greatly increase the natural hay crop of crab grass, which will render the peas more readily cured. On a swamp land farm we would never think of selling the crops in any shape but as beef and pork.

#### THE SANDY LANDS OF THE COAST REGION.

We have to some extent referred to the treatment of these, but there is such a capability for a diversification of crops on these lands that we refer again to their treatment. Throughout all the eastern part of the state the wide areas of flat sandy soil underlaid by a compact clay subsoil offer the best possible opportunity for easy and successful improvement. These lands are naturally more deficient in the mineral elements, such as potash and phosphoric acid, than the red clay uplands, and hence in the start of their improvement there is greater need for the application of fertilizers than in the upland country, where the mere improvement in the mechanical preparation of the soil will do far more. There are few of these Eastern sandy soils where there is any need for the subsoiling we have advised for the upland country. Where the clay is near the surface or where there are local sections of clayey soil such as one finds between Trenton and Pollocksville in Jones county, and to some extent in other eastern sections, the same treatment as to deep plowing and subsoiling is advisable, provided the soil is either naturally or artificially well drained. Subsoiling is of no use whatever in a water-soaked soil, for it soon returns to its former condition. But where the land is clayey in its nature and well drained, the subsoiling will be of advantage. There are also soils that should never have the subsoil turned up. The sterile subsoil of a pipe clay soil in its undrained state is always such that the turning of it to the air will make the soil worse instead of better. These pipe clay soils are really composed of more sand than clay, but the sand is so fine as to be quicksand when wet, and has clay enough in it to make the hardest kind of clods when dry. It is a soil that is naturally sterile, and the only thing that can be done for its mechanical improvement is by underdraining and liming. When well underdrained, the soil may be deepened by subsoiling, but the plowing on such land with a turning plow should never be anything but shallow. But it is mainly of the treatment of the wide areas of sandy lands with a clay subsoil that we would here treat. Much of the area of these lands has been so reduced in fertility by the constant cultivation in cotton that any start in their improvement must begin with an application of plant food. On

these lands is the paradise of the cow pea, and in no section of the state can greater results be had from the growing of the pea than on the sandy coast plain lands. They are the easiest of all lands in the state to improve and the quickest to run down by bad treatment. Hence the need of constant systematic farming to conserve the fertility and to keep it advancing instead of running down. The great temptation to the farmers of that section of the state is to get hold of a fresh piece of land and run it in cotton till it fails to yield a good crop, while by proper treatment the lands can be kept up and constantly increasing in productiveness. The eastern section of North Carolina is not a wheat growing section. Soil and climate are both against, and while we fully believe in growing a diversity of crops we do not believe that a farmer should grow a little of everything. While one-crop farming has run the lands down and should be abandoned, there is no reason why the cotton farmers of Eastern North Carolina should not make a specialty of cotton. There is a great difference between a specialty and a single crop. In farming with a specialty, we so arrange the rotation that the growing of the other crops tends towards the greater production of the specialty in the most economical manner. In the nature of things cotton will always be the leading money crop of this section even where tobacco has come in for a share of attention, for there is no need for the one interfering with the other since the tobacco crop can usually be gotten out of the way before the cotton picking begins. We have long been of the opinion that the man who inaugurates the culture of cigar tobacco in Eastern North Carolina will do more for himself and his section than by trying to grow the same kinds that are so successfully grown in the northern part of the state. But to take up the idea of the improvement of the sandy eastern lands. We have said that this is the paradise of the cow pea. Clover is out of the question. It can not be depended upon and it is well that it can not, for the cow pea in these lands will do far more than clover will anywhere, and no one in Eastern North Carolina should waste time in experimenting with red clover, or for that matter with any of the clovers. After the land has been brought up and the mineral matters plenty in it, the annual crimson clover may easily be grown as a winter crop in preparation for the corn crop. Many attempts have been made to grow this crimson clover in Eastern North Carolina but they have generally failed because the soil is not in condition to grow it. But when the soil is brought up in fertility it can be successfully grown. I saw an instance of this in the flat, sandy soil about Darlington, S. C. There the crimson clover is generally a failure as in the sandy plain country generally. But near Darlington a livery stable man in the town had some lots just outside where he hauls his stable manure and grows therewith some wonderful crops of all kinds.



On one piece of land he sowed crimson clover and made a wonderful crop and showed that the reason for the failure of the others was the poverty of the soil. Red clover and all the perennial clovers that grow through the whole year can never be a success on the sandy soils of Eastern North Carolina, but when once the soil is gotten into a fertile state the annual crimson clover, which grows through the cool season only, can be grown with perfect success and can be made a valuable adjunct to the cow pea.

Starting, then, with a piece of sandy land only capable of making a meagre crop of corn, we would not run its fertility down further by the growing of a hoed crop even with the aid of fertilizers. We would start at once with the cow pea. Give the land a dressing of acid phosphate and potash mixed in the proportion of four or five parts of acid phosphate to one of the muriate of potash, and use of this 300 lbs. per acre. This will give a fairly good growth on the thinnest soil. If the object is the rapid improvement of the land at once, without regard to the most economical method, then let the crop die on the land and remain till time to prepare it for the cotton crop. At this stage we would use another dressing of the same mixture under the cotton. The dead peas will give all the nitrogen needed, and in addition the seed of last year's cotton can be buried down the middles as before suggested so that the plants will find them at fruiting time. At picking time or just before finishing it sow rye all among the cotton to prevent the wasting of fertility in the winter rains. After a while crimson clover can be used for this purpose, but at first it is more certain to use the rye, as it will grow and make a soil cover though not near as valuable as the clover. Now, during the winter get out all the manure you can get hold of and all the black earth you can rake from the woods and try to cover the field all over with something. Prepare it in spring for corn. Do not waste commercial fertilizers on the corn, for you can not make it pay to do so. Plant the corn early so that you can have it ripe enough to cut down during the dry weather of the early fall. Cut it off at the ground after the August rains are over, and cure it in the shock. In September harrow the land with a disc and make the surface fine and sow the Virginia turf oats at rate of three bushels per acre. It may be well at first to give these a little of the mixture of acid phosphate and potash, but in any event, after the oats are cut give the same dressing for the peas that are to follow. Then repeat the rotation, but by this time it will be best to cut the peas and cure them for feed and get more stock to eat them up, and save the manure to go on next year's corn. By the time you have been twice around in this three year rotation, and have dressed the corn field twice with manure and woods earth you will find that the only place you need to use any fertilizer at all is on the oats stubble that is to go in peas.

There is the place where the fertilizer will tend to the building up of the soil most. You will never need to buy an ounce of nitrogen or ammonia, for the peas once in three years will give you all you need when aided on the cotton by the seed of the year before. Of course if you can get near by a fair exchange of meal and hulls for the seed it may pay you to make the exchange, but if this is not the case then use the seed and put them—not under the cotton to interfere with the stand—but in the middles where the wide reaching roots will find them as soon as they are rotted and will find them just when they need them most. The keynote to all this is the keeping the land at all times covered, especially in winter to prevent washing from rains, and the putting of homemade manures just where they will do the most good to the intermediate crops, and the commercial fertilizer where it will produce the best results in the getting of feed to make manure and in fixing nitrogen in the soil for the cotton crop that follows. When you get your land up to this point, you will be less anxious about the price of cotton, as you will know that you are not obliged to sell it to pay a fertilizer bill. Then from the feeding of the corn and forage grown you should be able to get cash that will enable you to carry on farming on a cash basis, and be rid of the great drain that long credit makes on a man's pocket, for with the cash you can be getting instead of paying interest.

After you have followed this rotation for a while and find that instead of a fourth of a bale of cotton you have gotten a bale or more, do not be tempted to break up the improvement and put a field in cotton a second year simply because it made a big crop last year, but persevere till every field on the farm will make the highest yield. Then, too, do not argue that as all your land will make a bale per acre it will not pay you to grow corn that does not pay as much cash as cotton. You need the corn and the oats to keep up the land, for as we have said while that level sandy soil quickly responds to improvement, it quickly reverts if badly treated. If you grow the other crops you will soon become interested in the stock raising and feeding, and will find farming with cotton something far beyond the mere cropping it has always been to you. With some such system of cropping and stock feeding Eastern North Carolina would soon become a veritable Egypt in productiveness, and plenty will reign over her broad acres and population will flow in where good farming is done.

#### CARE OF THE HOMEMADE MANURE.

The growing of plentiful supplies of pea-vine hay and the making of ensilage from the corn and pea vines will give a new value to the manure made, for it is a well-known fact that the value of



the manure depends on the quality of the food consumed. Cattle that are starved through the winter on corn shucks and straw make manure that is worth little more than the rotted stuff from the forest if as much. Cattle fed on a rich and well combined ration not only thrive on it, but their droppings return the quality of the food fed. Hence a single load of manure from highly fed cattle is worth many loads of that from cattle that have had a poorly balanced ration or have had just enough of something to keep them alive through the winter. These facts of themselves are sufficient to induce a better feeding of domestic animals. But it is not enough to make rich manure by good feeding. It must be handled so as to preserve its value for the nitrogen in the manure leaves us very rapidly under certain conditions. If thrown out under the eaves where the rain falls on it, the soluble portion, that is the most valuable for plants, soon washes away. If thrown out in piles it soon heats and the ammonia is changed into a carbonate and flies off in the air as we can ascertain by our nose. The pungent odor of a heating manure pile is the nitrogen getting away in the form of ammonium carbonate. That nitrogen has cost you money, and if you have to buy it in a fertilizer you will have to pay about 15 cents per pound for all that you are allowing to waste in the air. The best place for manure is out on the field where some plant can get the use of it. If you are farming in the rotation described you will have during the winter either rye or crimson clover growing after cotton, and to be put in corn. Then as fast as the manure is made do not throw it out to "waste its sweetness on the desert air," but get it at once out and spread it on the land that is to go into corn the next spring. There it will increase the clover or rye growth and be in condition to do more for the corn. It may dry some when spread on the surface, but it will not lose the ammonia to any appreciable extent. If for any reason this course is not practicable the next best thing is to allow the manure to accumulate in the stable, and to be kept trodden under foot of the animals, using, of course, plenty of bedding to absorb the urine. Kept in this way there will be no violent heating and the manure will not be washed away. I visited a prosperous farmer on the sandy soils of Eastern South Carolina some years ago in August. He was stall-feeding beef animals summer and winter, and selling them as the butchers wanted them. At the time of my visit I found him cleaning out the accumulated manure from the stables and spreading it between the rows of cotton on a field that promised a full bale per acre. I asked him if he thought the fresh manure could be of any great value to the cotton on a field that promised a full bale per acre. I asked him if he thought the fresh manure could be of any great value to the cotton at that stage of its growth, for the first bolls were then about opening. He replied that he was not putting it there for the cotton,

though he thought that it would do that no harm, but he intended to sow that cotton in crimson clover to grow the next winter in preparation for his corn crop, and knew that the manure on top the ground would make this more certain, and that he would save what he would have lost had he piled the manure in the yard. I then no longer wondered that this man had built a handsome residence and was living the life of a country gentleman on a soil naturally as poor as any of our piney woods land. He was using brains in his farming. This is the great necessity after all—the use of brains and thought in one's work. It is impossible for me to give plans here that will fully meet the conditions of each. I can but suggest plans. The thoughtful farmer must use his own brains in adapting any advice to his work.

#### TRUCKING AS AN ADJUNCT TO GENERAL FARMING.

So far we have said nothing about the trucking of the eastern section. There is a tendency among the farmers of Eastern North Carolina to mix a little truck growing with their farming. As a rule we believe that this is a great mistake. The men who are doing this are those whose inferior products glut the market at times and render worthless the crops of the real gardeners. Trucking is a business of itself, and can not be well carried on by a farmer engaged in general cropping. A man should be a farmer all the way through or a gardener and nothing else. Still while the general trucking for the Northern markets should be left to the men who have invested capital and labor in it as a business, and can not be as a rule made profitable when used as a side issue, there is a certain kind of trucking that nearly every farmer can do and should do. This is the growing of such things as are in demand in his local market, and which can be used through the year as a source of family cash. Few of the markets in our North Carolina towns are supplied with home grown vegetables and fruits. By far the larger quantity of these things sold in towns like Raleigh, Winston, Charlotte and Wilmington are brought over the railroads from North and West. If every farmer would make himself familiar with the cultivation of vegetables and would devote a piece of land to this purpose and give it the best attention, so that whenever he is compelled to go to town he can carry along a load that will buy what he wants, and will keep him in cash during the summer, it would be found one of the most profitable additions to the general farming of the state. The great increase of the cotton mills of the state, with their crowds of operatives that must be fed, opens up local markets in many sections remote from the large towns and the thoughtful farmer will take advantage of these things.

## PASTURE.

The keeping of live stock necessitates pasture for them in summer. Land is too cheap here for the soiling of cattle in summer on cut green food to be made profitable. But when a man has the greater part of his land in a three- or four-year rotation either as a grain or cotton farm, and lives in a "no-fence" district, he can not graze his cropping land, and does not wish to. The question of a permanent enclosed pasture then becomes of prime importance. And that such a pasture can be made in all parts of the state we know full well, if the proper grasses are used and they are properly treated and cared for. In the upper districts this is a far easier matter than in the coast country, but even there there are grasses that will make a permanent sod. The pasture must be near the farm buildings as a matter of convenience and the soil should be well prepared before seeding. In all the upper red clay country the main reliance should be in orchard grass for a permanent pasture, but in all sections there will finally be a mixture of the native grasses in any pasture. For a permanent pasture the seeding must be heavy, for the sod should be quickly and thickly made if any success is desired. In the upland section we do not know of any better mixture of grasses than orchard grass, red top and Virginia blue grass (*Poa Compressa*). One bushel (14 lbs.) of each will be the quantity to sow per acre. Do not sow any white clover, as you will have plenty of it any way, and it is not desirable where horses are to be pastured, as it slobbers them too much. Make the sowing in September or October, and harrow the seed in with a smoothing harrow. Do not pasture it till late the following summer and then but little. Better give the grass a chance to seed and thus increase the density of the sod.

When we come to the level lands of the east we have different conditions. Here the grasses named do not as a rule succeed so well. But there is one grass that is hated by the cotton farmer, but which is of all others the best pasture grass for the east. This is the Bermudagrass. There is no danger that it will get into the cotton fields if care is used, as it does not make seed here, and can not thus get into the manure. It can easily be kept in bounds and as a summer grass for pasture it has no superior. But it is a summer grass only and hence needs some mixture to make a winter pasture. This can be found in the Texas blue grass, a grass that has a creeping stem like the Bermuda and can be grown in the same manner. This is a winter grass entirely and seldom makes any show in hot weather. The way to get a sod of these grasses is to get the creeping stems, commonly but erroneously called roots. Run these through a feed cutter and then mark out shallow furrows about two feet apart over the land, scatter the cut stems in these, cover and



roll. This can be done in spring or fall, but for the Bermuda is best in spring. By the end of summer the grasses will have taken possession of the whole land and the density of the sod will increase from year to year as the creeping stems run to and fro. We have seen such a sod on the sandy pine lands of South Carolina that was as dense and springy as the best blue grass in Kentucky, and the fine stock kept on the place attested by their looks the value of the feed. While the Bermuda grass should never be allowed in the upper red clay lands where other grasses can be grown, there is no better grass for pasture where it is at home in the eastern section.

#### HOGS FOR NORTH CAROLINA.

Experience has long ago demonstrated that no white hog can be a success in the South. The black razor back of the piney woods is the survival of the fittest, for the white hogs soon succumb here to the effects of mange and sun scald. There are a number of the black breeds that have been tried in the South with varying success. The Essex is preferred by some who take especial pains with their hogs and do not expect them to hustle for themselves in the woods. But many consider them too small in size and too delicate in constitution. The Poland China has become the popular hog over a large part of the country, particularly in the West. The chief objections urged against them are that they are not as prolific as other breeds, and that they make a larger quantity of woolly hair that makes them harder to clean. In my own experience I have found the Berkshire to more nearly fill the bill than any other breed. Where hogs are allowed a woodland range the Berkshire is as good a hustler as the native razor back, and this is true of them to a greater extent than any of the improved breeds. Then, too, as the hams are the most valuable part of a hog's carcass, there is no breed that makes as round and well-shaped hams as the Berkshire. In the hands of one intelligent farmer of South Carolina I found several years ago a stock of pigs raised from crossing a Berkshire on the sows of the Essex breed. These seemed to me to be the ideal pig for the South, having all the delicacy of bone and small offal of the Essex, with the hardy and prolific character of the Berkshire. But whatever breed is kept it should be one that will fatten at any age, for there is no profit in a hog that has to be wintered over before killing. No hogs should be kept over winter except the breeding stock, except in the case of fall litters to be fattened and killed in the early spring. When an improved breed is kept pure there will always be demand enough for breeders to take up the fall litters in the spring. The best time in the South to have the pigs come is in March. Then vegetation begins

and soon there is grass to turn them on if one keeps a permanent pasture. The cows are then giving a full flow of milk, and skim milk can be had for the pigs. If kept growing during the summer on green food of any kind and turned on a pea field as soon as it is ready for them, the pigs can be kept growing and can be sold off to the butchers alive at six months old, or can be kept till December and slaughtered for bacon, after a proper feeding of corn in the fall. At the Alabama station it was found that a field of peas fed off when ripe by hogs gave a profit of \$10.50 per acre, and the land was enriched by the trampled pea vines and the droppings of the animals. In many sections this may be the best use for the pea, though in most places the larger part of the pea crop will be more profitably harvested as hay for the feeding of stock. But on all our farms it will pay to have a lot of peas in which the hogs can feed and fatten till corn time. In the upper clay country, where clover will thrive, the place for the hogs in the early part of the season, till the peas are ready, is in a blooming field of clover, with noses jewelled to prevent rooting. Here they will thrive well till the earliest peas are ripe and after that with a succession of peas the hogs can be kept growing and fattening till corn comes in and the finishing time in the pens is at hand. This method of breeding and treating will be found far more profitable than the ranging of the woodlands. Of course hogs kept in this way will need attention as to having a supply of clean water, shade from the sun, and an occasional dose of salt and wood ashes and cinders. They will be far less liable to cholera than those allowed to run and come in contact with other animals. If all dead animals were promptly buried out of reach of dogs and buzzards it would be far easier to keep clear of cholera than it is now. The worst attack we ever had of hog cholera was brought to us by buzzards which attacked a hide that I was trying to cure on the side of my hog house. This taught me a lesson I have never forgotten, and I have ever since kept out of the way everything that can attract the buzzards, which are the great carriers of the hog plague. If you keep rid of buzzards, prevent contact of your hogs with others, and feed them during the warm weather with green succulent food, and no corn till cool weather and fattening time you will hardly ever be plagued with the cholera, particularly if they do not come in contact with streams of water that may bring infection from dead animals carelessly thrown into it above. See that the water they have is pure and uncontaminated, and the food is all right and you need have little fear of the cholera.

#### HAMS AND BACON.

We have said that the selling of raw products will never be as profitable as the turning of them into a more costly form. The live

hogs are to some extent a manufactured product of the peas, clover and corn, and they make a better use of these than the selling of the raw products would. But the manufacturing idea may profitably be further extended in the case of the hog, and the cured product will bring more money than the animal on the hoof. The great success that has attended the home curing of hams and bacon in the southeastern counties of Virginia shows what can be done with the hog on the farm. The great mass of the hams, so called, sold on the market, are the product of the great packing houses in the West. To one who knows a well cured ham these so-called hams are an abomination. The hams freshly slaughtered are injected with brine and saltpetre, and then run through a vat of a sort of creosote solution and at once placed on the market as smoked hams, when they have never been properly cured nor smoked. One who has been accustomed to well cured hams and well smoked ones does not wish to taste any of this meat at all after he has once tried it. The Smithfield hams of Virginia have gotten their reputation from the fact that they are cured in the old-fashioned way, and are really well smoked with hard wood smoke. In no other way can a well cured ham be made. Some of our North Carolina farmers have of late years gotten into the notion that smoking is no longer needed, but that a ham properly cured and then hung up and dried is all that is needed. But whatever the individual taste may be in this matter, the market demands a well smoked ham, and there is no doubt that the smoking gives the proper flavor that people like in a ham. When one is making a product for the market he must make what the market demands if he wants to get the best price. Go into the grocery stores in Raleigh to-day, and you will find the so-called sugar-cured hams of the packers, the well smoked hams of the southeast Virginia country, and the white dried hams of the surrounding farmers. Of the three, the highest price by far is asked and received for the Virginia hams, and the lowest price for the North Carolina hams. There is no reason whatever that the North Carolina hams should not command as high a price as the Virginia hams except that they are not treated as the market demands. The Virginia curer knows that the market wants just such a ham as he has always been making, and he makes no experiments with dried or unsmoked hams. With Smithfield hams selling for double the price of those of the packers and those of the North Carolina ham dryers, it should teach our people what is the profitable course for them. They may like the white dried hams, but the city buyers do not want them and they are sold at a lower price in consequence of the neglect of the packers to put them in shape for the market. Some years ago I was at the residence of a large and successful farmer in an adjoining state. He lived in the flat, sandy, piney wood section, yet he kept improved stock of all kinds, and



made a profit from them while getting his acres up to the average of over a bale of cotton per acre. Sitting on his porch one evening I saw a wagon drive up from a grocer in the neighboring town and it was soon loaded with well smoked hams and sides. The owner told me that the bacon cost him per pound just what his cotton cost, and he got for the cured bacon fully three times the cost and for the hams nearly four times, and that to the extent it could be carried on his farm, the curing of hams and bacon was far more profitable than cotton growing, but said he, "All go together to make up the product of a farm, and to keep me on a cash basis." There was the true secret of success, to have something at all seasons of the year to bring cash, and to prevent the heavy interest that the credit man has to pay on what to him are only "supplies" but to the other are a source of no small income. So long as our people look upon all other crops outside their money crop simply as "supplies" and never expect to make profit out of them through systematic farming, just so long will the cotton growers be at the mercy of the money lender and the fertilizer mixer. If anything we have written here will aid them in getting out of this slavery we will be abundantly rewarded for our work.

#### HOW TO CURE HAMS AND BACON.

There are two methods of curing on the farm—dry salting and pickling. Dry salting is more largely practiced than pickling, but in our experience we have been led to prefer the pickling. We prepare a brine strong enough to float a potato, and after the meat is cut and trimmed it is dropped into this brine for two or three days to draw out the blood. It is then taken out and a fresh brine is made, or the old brine boiled and skimmed. To the brine we then add one ounce of saltpetre and a pint of black molasses for each 100 pounds of meat. The meat is then returned to the brine, the thinner parts being put to themselves and the hams and shoulders in another cask. The thin parts remain in the brine three weeks and the hams four or five weeks, care being taken to keep all under the brine. The meat is then taken out and hung in the smoke house or elsewhere to drip and dry somewhat. It is then slowly smoked with corn cobs or hickory wood, the smoke being smothered down with green cedar branches if they are to be had. The smoking is continued for several weeks in favorable cloudy weather, until all are well smoked. The hams should have the upper part of the smoke house, where the smoke hangs longest. In the early spring the hams are taken down and rubbed well all over with a mixture of molasses and black pepper. They are then wrapped in stout paper and put into cotton bags, which are dipped in whitewash, and are again hung up. Some pack them down in chaff, but we prefer

to keep them hanging. They are at their best for the table or market at a year old, and one who tastes a year-old or older ham cured in this way never wants to taste the "embalmed hams" of the Western packers again as long as he lives. Hams of this kind will bring 18 to 20 cents per pound when the hams of the West and the white hams of our farmers are selling for ten cents per pound.

#### IMPROVING THE CORN CROP.

Corn is the staple crop for the fattening of hogs and other animals, and the increasing of its productiveness is a matter that should interest every farmer. We have already told how we would use the crop in a rotation, but there is another point on which there is great need for information. This is the proper saving and improving the seed. Farmers write to the station from all over the state, asking our opinion of the value of the various new kinds of corn offered by seedsmen. They never seem to realize that it is in the power of every farmer to so improve the corn he grows that it will always be the best he can get for his planting. Corn, more than most of our farm crops, needs to be developed in the climate where it is to be planted. Corn brought from far North or far South will never do as well here until it gets acclimated as the corn we already have. Every fall, at the State Fair and at the county fairs, one sees magnificent ears of corn shown, and people try to get some of it to carry home. We have learned long ago that these extra large ears have grown on single-eared stalks and a long ways up from the ground, and that to get a greater productiveness we do not want these great ears. When one starts out to improve the character of his seed corn, he should not look to a single feature but to the general character of the plant. Our Southern corn from the careless manner in which the seed has been selected, has been getting further and further from the ground to the ears, and has developed the habit of making a single big ear, and a great many barren stalks. A year ago we were travelling in the beautiful valley of the upper Yadkin and passed a field of corn that at first sight seemed marvellous in its growth. But a close inspection showed that in this mass of foliage and stalks there were almost as many stalks with no ears as there were with ears, and those that had ears had but a single one. This is the result of a careless selection of seed. The barren stalks have the tassel, the male organ well developed, and they are spreading their pollen all around to infest the others, and seed saved from that field, while it may show magnificent ears, will be worse than worthless. When one starts to get an improved strain of corn he should select the best kind that he can find in the neighborhood. Plant a piece especially for seed. When the tassels first begin to show, and before they have ripened pollen,



go through and cut the tassels from every stalk that does not show silks, and so prevent these barren males from affecting the crop. Then, when the crop is ripe, go through again and take the lower ear from a stalk that has two or more, and never take one from a single-eared stalk. You will find that these lower ears are not as fine looking as the upper ones, but we are after getting the hereditary tendency of making an ear above the one selected. We could easily select the best looking ears in the crib, and that is what has ruined the corn, and given it a tendency to make but one ear and that higher and higher from the ground. We want to cure this and get a twin-eared corn and one that has less stalk between the ear and the ground. So no matter if the lower ear is not so good looking as the upper one, take it for seed, and breed for the general character of plant rather than for a single feature as in the past.

Then next season plant your seed patch from this seed as well as your main crop, and continue in the seed patch the selection as before. After you have carried on this selection for a few years you will begin to see a great improvement in your corn. It will grow shorter and more sturdy, not so liable to blow down and will get into the habit of making two or more ears. Then in a few years of this careful selection and re-selection, you will find that your neighbors who will not take these pains will be taking an interest in your corn, and you can sell it for seed to advantage. Another result of a better character of plant will be the fact that you can grow the corn nearer in the row and the rows nearer than corn is now planted, and thus increase the product of your acres. There is hardly a farm in the piedmont section where the corn crop by good farming and good selection of seed could not be raised to at least 50 bushels of corn per acre or even more. When we get our corn to 50 bushels per acre and the wheat and oats to a proportional yield, we will find that what we have been looking at simply as "supplies" have reached a point of profit.

It is towards this that the Experiment Station is working. The station was established to help the farmer, and in the present state of agriculture in this state we know of no way in which we can help him more than by disseminating information on the topics that interest him, and by always being ready to answer letters from the farmers on everything on which they feel that they need information. In this bulletin we have endeavored to give hints that acted upon can not fail to advance the welfare of the toilers on the farms, and if anything we have written aids in the elevation of the work of the farmer to a higher plane and a more profitable use of the soil and its products we will feel that we have done a good work.



## RECENT BULLETINS.

The following are some of the recent Bulletins of the Experiment Station :

- No. 100. Our Common Insects, cuts 65, pp. 36.
- No. 101. The Progress of the Dairy Industry in North Carolina, pp. 8.
- No. 102. Encouragement to the Dairy Industry, pp. 12.
- No. 103. Miscellaneous Agricultural Topics, pp. 24.
- No. 104. Why Pull Your Corn Fodder? pp. 4.
- No. 105. The Chestnut and its Weevil; Nut Culture, pp. 12.
- No. 106. Rational Stock Feeding, pp. 44.
- No. 107. Propagation of Flowering Bulbs in North Carolina, plates 24, pp. 24.
- No. 108. Seed Testing; Its Uses and Methods, pp. 64.
- No. 109. Feeding Trials With Animals, pp. 34.
- No. 110. Marls and Phosphates of North Carolina, pp. 50.
- No. 111. The Fertilizer Control During 1894, pp. 26.
- No. 112. Trucking in the South, pp. 70.
- No. 113. The Testing of Milk, cuts 4, pp. 32.
- No. 114. Tests of Dairy Implements and Practices, cuts 4, pp. 32.
- No. 115. Miscellaneous Agricultural Topics, pp. 20.
- No. 116. Milk Records and Tests, pp. 16.
- No. 117. Tuberculosis and its Prevention, pp. 20.
- No. 118. Cotton Seed Hulls for Beef Production, 4 pages.
- No. 119. Volumetric Estimation of Phosphoric Acid, 21 pages.
- No. 120. Cultivation of the Peach Tree, 42 cuts, 31 pages.
- No. 121. Hillside Terraces or Ditches, 8 cuts, 5 pages.
- No. 122. Types of Tobacco and their Analyses. (Technical.) 35 pages.
- No. 123. Miscellaneous Agricultural Topics, 10 pages.
- No. 125. Forage Grasses and Hay Making, 44 cuts, 49 pages.
- No. 128. Pests of Grain Crops, pp. 12.
- No. 129. Horticultural Experiments at Southern Pines, 1895, pp. 46.
- No. 130. Poultry Keeping for Profit, 39 cuts, 53 pages.
- No. 132. The Home Vegetable Garden and its Pests, 8 cuts, 54 pages.
- No. 133. Some New Forage Fibre and Other Useful Plants, 2 pages.
- No. 136. Fertilizer Analyses of the Fertilizer Control, 34 pages.
- No. 137. A Warning in Regard to Compost Peddlers, 8 pages.
- No. 138. San Jose Scale in N. C., 1 cut, 14 pages.
- No. 139. Home-mixed Fertilizers and Composts, 16 pages.
- No. 140. Volumetric Estimation of Phosphoric Acid. (Technical.) 8 pages.
- No. 141. A New Tobacco Pest, 2 cuts, 8 pages.
- No. 142. Comfortable Low Cost Barns, 12 cuts, 20 pages.
- No. 143. Feeding Experiments, Milk Records, etc., pp. 36.
- No. 144. Ornithology of North Carolina, pp. 36.
- No. 145. Crimson Clover, pp. 20.
- No. 146. Miscellaneous Farm Bulletin, pp. 16.
- No. 147. A Study of Lettuces, pp. 8.
- No. 148. Digestion Experiments, pp. 32.
- No. 149. The Apple in North Carolina, pp. 22.
- No. 150. Medicinal Plants of North Carolina, pp. 84.
- No. 151. The Fertilizer Control for 1897, pp. 12.
- No. 152. Poultry Notes, pp. 24.
- No. 153. Vinegar Adulteration, pp. 8.
- No. 154. The Adulteration of Coffee and Tea, pp. 16.
- No. 155. Baking Powders on Sale in North Carolina, pp. 8.
- No. 156. The Adulteration of Flour, pp. 12.
- No. 157. Mineraline, pp. 8.
- No. 158. The Fertilizer Control for 1898, pp. 16.
- No. 159. Horticultural Experiments at Southern Pines, 1896, pp. 92.
- No. 160. Digestion Experiments, pp. 20.
- No. 161. Drinking Water, pp. 20.
- No. 162. Farming in North Carolina, pp. 34.

Any of the above will be sent cheerfully upon application by postal card to the Director of the North Carolina Agricultural Experiment Station, Raleigh, N. C.